THE UNIVERSITY OF TEXAS-PAN AMERICAN

Department of Mathematics

Math 2346.01: Math for EE and CE Spring 2013 ENGR 1.274 MW 13:10-14:25

Contact information

Instructor: Dr. Eleftherios Gkioulekas, Department of Mathematics
E-mail: drlf@hushmail.com
Web: http://faculty.utpa.edu/gkioulekase/index.html
Office hours: MW 14:45-17:00 F 09:45-10:45
Office location: MAGC 3.214

Course information

Prerequisites: CSCI 1380 or CMPE 1370 or CSCI 1370 with a grade of C or better, and MATH 1460 with a grade of C or better.
Corequisites: None.
Course Description: This course covers the essentials of matrix theory, graph theory, numerical methods, and introduction to proofs needed for majors in Electrical and Computer Engineering. Topics include Gauss-Jordan elimination, matrix algebra, determinants, graphs, trees, root finding algorithms, numerical differentiation, numerical integration, numerical matrix methods, propositional and predicate logic, and formal logic proofs.

References

E. Gkioulekas (2009): "Lecture Notes on Mathematics for Electrical Engineers", 268 pp. (textbook)

See course website for hyperlinks.

Outline of Topics

- **Brief introduction to logic and sets**
  Propositions and sets
  Predicates and quantified statements
- **Linear Algebra**
  Matrices
  Basic operations with matrices
  Matrix multiplication
  Matrix inverses
  Matrix transpose
  Determinants
  Cofactor expansion of determinants
  Simplification of determinants
  $n \times n$ linear systems of equations
    Matrix inverse
    Cramer's rule
    Gaussian elimination
- **Brief introduction to proof**
  Negation and contrapositive of statements
  Methodology for writing proofs
- **Graph theory**
  Graphs – Basic terminology
  Types of graphs
  Relations between graphs
  Subgraphs
  Graph operations
  Connected graphs
  The Laplacian matrix
  Graph connectivity
  Eulerian graphs
  Hamiltonian graphs
  Adjacency matrix
  Shortest path problem
  Trees

Minimum spanning tree problem (Kruskal's algorithm)
Planar graphs

- **Applications of linear systems**
  DC Circuits
  Superposition principle of circuits
  Least squares fit
- **Misc topics**
  Root finding algorithms
  Finite differences
  Integral approximations

Student Learning Outcomes

After completing this course students will be able to

(1) Perform the basic operations of matrix algebra.
(2) Solve a system of linear equations using Gauss-Jordan elimination, including augmented matrices and elementary row operations.
(3) Compute matrix inverses when they exist and solve linear systems using matrix inverses where applicable.
(4) Compute determinants of square matrices using the definition, elementary row operations, and cofactor expansion, know the basic properties of determinants, and solve linear systems using Cramer's rule where applicable.
(5) Compute eigenvalues and eigenvectors of a square matrix and apply them to problems in engineering, mathematics, and science.
(6) Know graph terminology, graph connectivity, Euler and Hamilton paths, planar graphs, and some of the major problems of graph theory, such as shortest path problems (solved by Dijkstra's algorithm).
(7) Understand trees, traversals of trees, sorting, and minimal spanning trees (Prim's and Kruskal's algorithms).
(8) Find roots of functions using the bisection, fixed-point, secant, and Newton's methods.
(9) Approximate derivatives of functions using finite differences.
(10) Approximate integrals using midpoint, trapezoid, and Simpson's rules.
(11) Apply formal methods of symbolic propositional and predicate logic.
(12) Know how to use formal logic proofs and logical reasoning to solve problems.
(13) Understand various proof techniques and determine which type of proof is best for a given problem.